

### 3.11 Service Aids

Table 3-1 lists service aids recommended for working on the PRO5150/PRO5350/PRO5450, PRO7150/PRO7350/PRO7450, and PRO9150/PRO9450 radios.

**NOTE** While all of these items are available from Motorola, most are standard shop equipment items, and any equivalent item capable of the same performance may be substituted for the item listed.

*Table 3-1.* Service Aids

Motorola Part No.	Description	Application
RLN4460	Portable Test Set	Enables connection to audio/accessory jack. Allows switching for radio testing.
HVN9027	Customer Programming Software (CPS): CD ROM. Includes images for high density, 1.4 Mbyte, 3.5" floppy diskettes.	Programs customer option and channel data. Tunes hardware parameters, front end, power, deviation, etc. Conventional and LTR products.
HVN9031	Customer Programming Software (CPS).	Same as above (MPT protocol products).
HVN9045	Customer Programming Software (CPS).	Same as above (800 MHz LTR protocol products).
HVN9065	Customer Programming Software (CPS).	Same as above (Privacy Plus protocol products).
AARKN4075	Programming Cable	Includes radio interface box (RIB) capability.
AARKN4074	Programming Cable/Test Cable	Connects radio to RIB (RLN4008B).
AARKN4073	Radio to Radio Cloning Cable	Allows radio to be duplicated from a master radio by transferring programmed data from the master radio to the other.
RLN4008	Radio Interface Box	Enables communications between radio and computer's serial communications adapter.
HLN9756	BNC Adaptor	Adapts radio antenna port to BNC cabling of equipment (VHF and UHF , B1 only)
5880313B69	SMA to BNC adapter	Adapts radio antenna port to BNC cabling of equipment (800 MHz radios)
HHLN4133A	Rhombic tip adapter (Yellow)	Adapts radio antenna port to BNC cabling of test equipment.
HHLN4134A	Cylindrical tip adapter (Blue)	Adapts radio antenna port to BNC cabling of test equipment.
RLN4510	Battery Eliminator 7.5V Regulator	Works in combination with Shop Battery Block, 0180305G54.

<b>Motorola Part No.</b>	<b>Description</b>	<b>Application</b>
AA0180305G54 AA8180384F68 AA8180384F66	Shop Battery Block Bench Test Housing Eliminator Bench Test Housing Eliminator	Interconnects radio to power supply. Provides for troubleshooting of radio when housing is removed. For use with PRO9150 long frame radio.
0180357A57	Wall-Mounted Power Supply (120 VAC)	Used to supply power to RIB.
0180358A56	Wall-Mounted Power Supply (220 VAC; 2-prong)	Used to supply power to RIB.
3080369B72	Computer Interface Cable	Connects computer's serial communications adapter to RIB (RLN4008B).
AAHLN9742A	Radio Software Upgrade Cable	Used with MPT protocol products.
6680702Z01	Service Tool	Remove radio chassis and knobs.

## 3.12 Test Equipment

Table 3-2 lists test equipment required to service the PRO5150/PRO5350/PRO5450, PRO7150/PRO7350/PRO7450, and PRO9150/PRO9450 radios.

*Table 3-2. Recommended Test Equipment*

Motorola Part No.	Description	Characteristics	Application
R2000, R2600 R2400, or R2001 with trunking option	Service Monitor	This monitor will substitute for items listed below with an asterisk *	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
*R1049	Digital Multimeter		Two meters recommended for AC/DC voltage and current measurements
*S1100	Audio Oscillator	67 to 200Hz tones	Used with service monitor for injection of PL tones
*S1053, *SKN6009, *SKN6001	AC Voltmeter, Power Cable for meter, Test leads for meter	<ul style="list-style-type: none"> <li>• 1 mV to 300 V</li> <li>• 10 M<math>\Omega</math> input impedance</li> </ul>	Audio voltage measurements
R1053	Dual-trace Oscilloscope	20 MHz bandwidth, 5 mV/cm - 20 V/cm	Waveform measurements
*S1350, *ST1215 (VHF) *ST1223 (UHF) *T1013	Wattmeter, Plug-in Elements (VHF & UHF), RF Dummy Load	<ul style="list-style-type: none"> <li>• 50 <math>\Omega</math></li> <li>• <math>\pm 5\%</math> accuracy</li> <li>10 W, max. 0-1000 MHz, 300 W</li> </ul>	Transmitter power output measurements
S1339	RF Millivolt Meter	100 $\mu$ V to 3 VRF, 10 kHz to 1.2 GHz	RF level measurements
*R1013	SINAD Meter		Receiver sensitivity measurements
S1347 or S1348 (prog)	DC Power Supply	0-20 Vdc, 0-5 Amps	Bench supply for 7.5Vdc

### 3.13 Configuring and Wiring the Programming/Test Cable

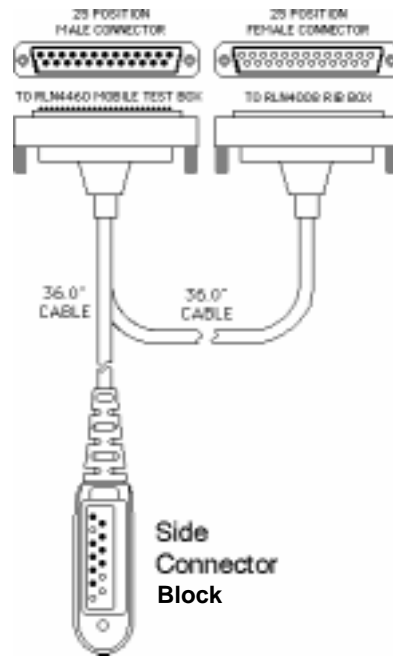
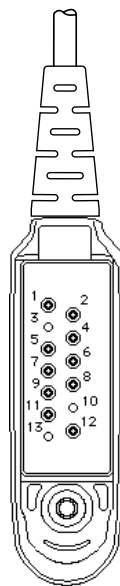
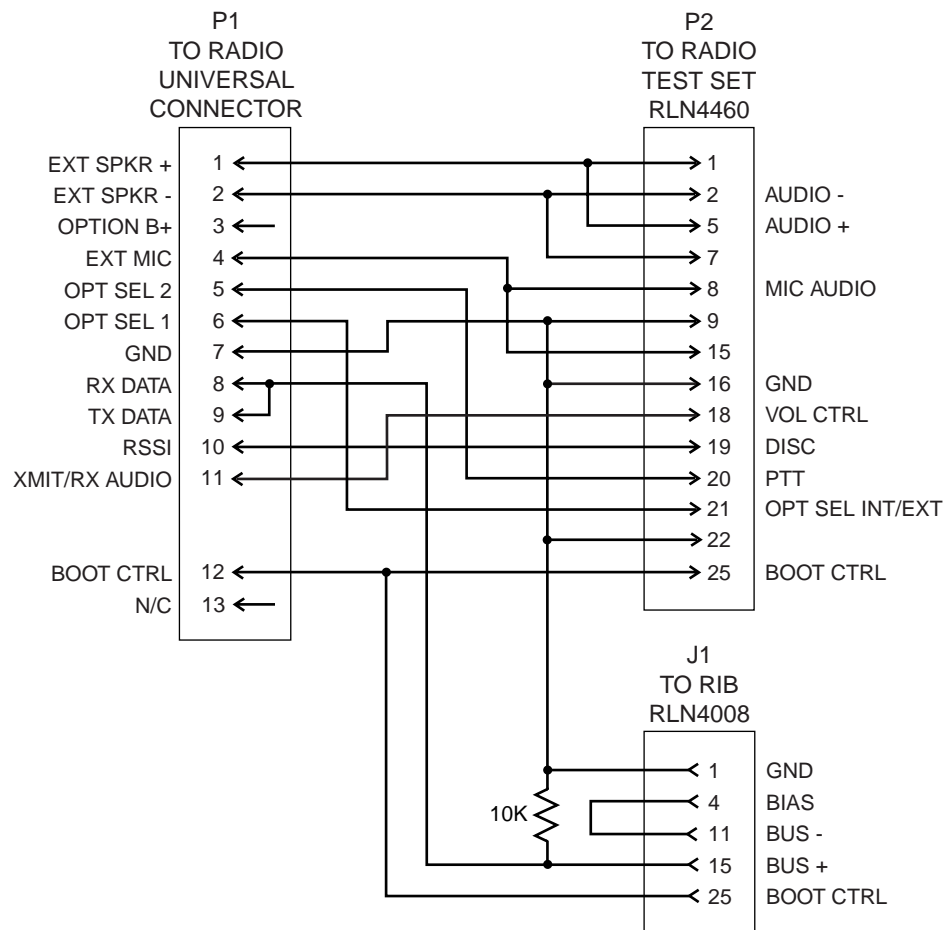


Figure 3-14. Programming/Test Cable AARKN4074



INTERNAL CONNECTIONS		PIN OUTS
1	EXTERNAL SPEAKER +	BRN → 1
2	EXTERNAL SPEAKER -	DK BLU → 2
3	OPTION B+	RED → 3
4	EXTERNAL MIC	GRY → 4
5	OPTION SELECT 2	LT BLU → 5
6	OPTION SELECT 1	TAN → 6
7	GROUND	BLK → 7
8	RX DATA	VEL → 8
9	TX DATA	PNK → 9
10	RSSI	ORG → 10
11	RXMIT AUDIO/RX AUDIO	VOI → 11
12	BOOT CONTROL	GRN → 12
13	NOT USED	WHT → 13

Figure 3-15. Pin Configuration of the Cable Side Connector



FL08300620

Figure 3-16. Programming /Test Cable Schematic

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## Chapter 4

# Transceiver Performance Testing

### 4.1 General

These radios meet published specifications through their manufacturing process by utilizing high-accuracy laboratory-quality test equipment. The recommended field service equipment approaches the accuracy of the manufacturing equipment with few exceptions. This accuracy must be maintained in compliance with the manufacturer's recommended calibration schedule.

### 4.2 RF Test Mode

When the radio is operating in its normal environment, the radio's microcontroller controls the RF channel selection, transmitter key-up, and receiver muting. However, when the unit is on the bench for testing, alignment, or repair, it is removed from its normal environment and cannot receive commands from its system. Therefore, the internal microcontroller does not key the transmitter or unmute the receiver. This prevents the use of a normal tuning procedure. To solve this problem, a special "test mode" is incorporated into the radio.

**Note:** The test mode procedure that follows assumes that the Customer Programming Software Front Panel Access screen has both the FPA and RF TEST boxes selected. Select from the programming screen to enable or disable certain features of the radio RF test mode.

- FPA entry not selected blocks all test modes.
- FPA entry selected and RF TEST not selected blocks RF test mode.
- FPA entry selected and RF TEST selected enables all test modes.

To enter the test mode for a display radio:

1. Turn the radio on.
2. Within ten seconds after the self test is complete, press side button 2, shown in Figure 4-1, five times in succession.
3. After "CSQ CHXX SP25" appears on the display, the radio is on channel XX (see **Note** below), carrier squelch mode, 25 kHz channel spacing. Each additional press of side button 2 (see Table 4-2) scrolls to the next channel spacing, and a corresponding set of tones are sounded. Refer to Figure 4-2 for test mode information for a four-line display radio.
4. Press side button 1 to scroll through the test environments listed in Table 4-1.
5. Press side button 2 for 3 seconds to switch the radio to the control head test mode. 'LCD Test' appears on the display.
6. Press side button 1 to turn on all the dots of the first character. Another side button 1 press turns on all the dots of the next character, continuing until the last character is reached.
7. Press side button 1 at the end of the LCD test to activate the 'Icon Test'. The next side button 1 press turns on the first icon.
8. Press side button 1 at the end of the Icon Test to activate the button test. Pressing any side button (except side button 1), or any keypad button during the LCD test or Icon test immediately activates this test. A good button press is verified by a chirp.

9. Press side button 2 for 3 seconds in the control head test mode to return the radio to the RF Test mode.
10. Turn radio off to exit test mode.

**Note:** XX = channel number (01 - 14)

To enter the test mode for a non-display radio:

1. Turn the radio on.
2. Within ten seconds after the self test is complete, press side button 2 (Figure 4-1) five times in succession.
3. Press side button 1 the number of times listed in Table 4-1 to get the number of corresponding beeps.
4. Turn radio off to exit test mode.
5. To access all 14 test modes on a 4-channel radio, the frequency knob and mechanical stop sleeve must be removed (see paragraph 3-8 exploded view diagram).

Button Test (For models with "G" in location 10 of model number Example: LAH25UCH6GB6AN)

1. Press the orange button; "3/1" appears which indicates that switch 3 is in the closed condition.
2. Release the orange button; "3/0" appears which indicates that switch 3 is in the open condition.
3. Rotate the mode selector knob; "4/0" through "4/15" appears which indicates that knob 4 is in mode position 1 through 15.
4. Rotate the volume control; "2/0" through "2/255" appears.
5. Press SB1, view "96/1"; release, view "96/0".
6. Press SB2, view "97/1"; release, view "97/0".
7. Press SB3, view "98/1"; release view "98/0".
8. Press PTT button, view "1/1"; release view "1/0".

Keypad (For models with "G" in location 10 of model number Example: LAH25UCH6GB6AN)

1. Press 0, view "48/1"; release, view "48/0".
2. Press 1, view "49/1"; release, view "49/0".
3. Press 2, view "50/1"; release, view "50/0".
4. Press 3, view "51/1"; release, view "51/0".
5. Press 4, view "52/1"; release, view "52/0".
6. Press 5, view "53/1"; release, view "53/0".
7. Press 6, view "54/1"; release, view "54/0".
8. Press 7, view "55/1"; release, view "55/0".
9. Press 8, view "56/1"; release, view "56/0".
10. Press 9, view "57/1"; release, view "57/0".
11. Press \*, view "58/1"; release, view "58/0".
12. Press #, view "59/1"; release, view "59/0".
13. Press <, view "128/1"; release, view "128/0".
14. Press HOME, view "129/1"; release, view "129/0".



15. Press >, view "130/1"; release, view "130/0".
16. Press Option Select1, view "135/1"; release, view "135/0".
17. Press Option Select2, view "136/1"; release, view "136/0".
18. Press Option Select3, view "137/1"; release, view "137/0".
19. Pressing SB2 for 3 seconds in the Control Head Test mode will cause the radio to return to the RF Test mode.

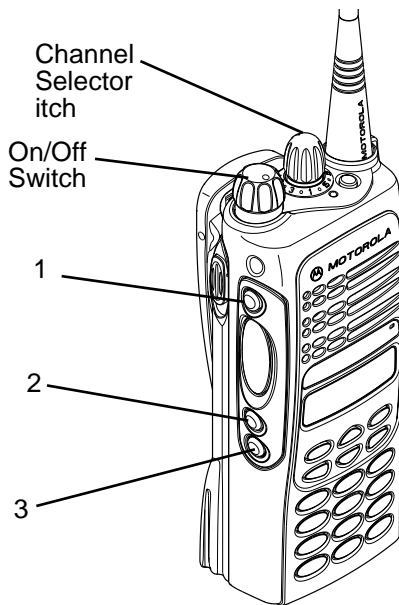


Figure 4-1. Radio Side Button Locations

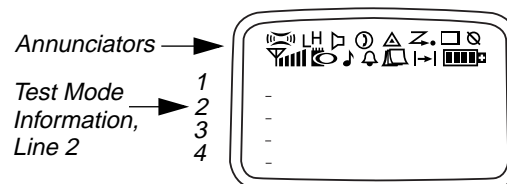


Figure 4-2. Four-Line Display

Table 4-1. Test Environments (Side Button 1)

Number of Side Button 1 Presses	No. of Beeps	Display Shows	Description	Function
Initial (No button presses required)	0	CSQ	Carrier Squelch	RX: if carrier detected TX: mic audio
1	1	TPL	Tone Private-Line	RX: unsquelch if carrier and tone (192.8Hz) detected TX: mic audio + tone (192.8Hz)
2	2	DPL	Digital Private-Line	RX: unsquelch if carrier and digital code (131) detected TX: mic audio + digital code (131)
3	3	DTMF	Dual-Tone Multiple Frequency	RX: unsquelch if carrier detected TX: selected DTMF tone pair
4	5	Open	Unsquelch	RX: constant unsquelch TX: mic audio
5	9	HSS	MDC1200	RX: unsquelch if carrier detected TX: 1500Hz tone
6	11	CMP	Compander	RX: if carrier detected TX: mic audio
7	12	LLE	Low-Level Expand	RX: if detected TX: mic audio

Table 4-2. Test Environments (Models with "G" in location 10 of model number EX: LAH25UCH6GB6AN)

Item No.	No. of Beeps	Description	Function
1	1 GKC	Carrier Squelch	RX: unsquelch if carrier detected TX: mic audio
2	1 BKC	Tone Private-Line	RX: unsquelch if carrier and tone (192.8Hz) detected TX: mic audio + tone (192.8Hz)
3	2 BKC	Digital Private-Line	RX: unsquelch if carrier and digital code (131) detected TX: mic audio + digital code (131)
4	3 BKC	Dual-Tone multiple frequency	RX: unsquelch if carrier detected TX: selected DTMF tone pair
5	5 BKC	Open squelch OSQ	RX: constant unsquelch TX: mic audio

Item No.	No. of Beeps	Description	Function
6	8 BKC	Trunking Low Speed TLS	RX: unsquelch if carrier detected TX: mic audio + connect tone (105-8 MHz)
7	9 BKC	Trunking High Speed THS	RX: unsquelch if valid outbound signalling word (OSW) detected TX: 1500Hz tone
8	11 BKC	CMP	RX: unsquelch if carrier detected TX: mic audio
9	12 BKC	LLE	RX: unsquelch if carrier detected TX: mic audio

*Table 4-3. Test Channel Spacing (Side Button 2)*

Number of Low Tones	Channel Spacing
1	25/30 kHz
2	12.5 kHz
3	20 kHz

### 4.3 Test Frequencies for Display and Non-Display Radios

The radio channels and test frequencies are listed in Table 4-4. The channels are selected using the channel selector switch located on top of the radio, as shown in Figure 4-1. The test environment and channel spacing for any particular frequency is selected using side buttons 1 and 2, as listed in Tables 4-1, 4-2, and 4-4. The display radio shows the selected parameters on the radio display, and sounds the corresponding number of beeps and tones listed in Tables 4-1 and 4-3. The non-display radio only sounds the beeps and tones.

*Table 4-4. Test Frequencies (Using the Channel Selector Switch)*

<b>Channel Selector Switch Position</b>	<b>Test Channel</b>	<b>Low 1</b>	<b>Low 2</b>	<b>VHF</b>	<b>UHF 1</b>	<b>UHF 2</b>	<b>800</b>
1 Low Power 8 High Power	TX #1 or #8 RX #1 or #8	29.740 29.740	35.040 35.040	136.025 136.025	403.025 403.025	450.025 450.025	806.025 806.075
2 Low Power 9 High Power	TX #2 or #9 RX #2 or #9	32.040 32.020	37.040 37.020	142.325 142.325	413.025 413.025	462.850 462.850	815.475 809.175
3 Low Power 10 High Power	TX #3 or #10 RX #3 or #10	34.040 34.020	39.040 39.020	148.625 148.625	425.025 425.025	475.675 475.675	824.925 812.325
4 Low Power 11 High Power	TX #4 or #11 RX #4 or #11	36.040 36.020	42.040 42.020	154.925 154.925	437.025 437.025	488.500 488.500	837.975 815.575
5 Low Power 12 High Power	TX #5 or #12 RX #5 or #12	38.040 38.020	45.040 45.020	161.225 161.225	449.025 449.025	501.325 501.325	851.025 818.675
6 Low Power 13 High Power	TX #6 or #13 RX #6 or #13	40.040 40.020	48.040 48.020	167.525 167.525	460.025 460.025	514.150 514.150	860.475 821.825
7 Low Power 14 High Power	TX #7 or #14 RX #7 or #14	42.040 42.020	50.040 50.020	173.825 173.825	469.975 469.975	526.975 526.975	869.975 824.975

## 4.4 Receiver Performance Tests

The receiver and transmitter performance tests are contained in Tables 4-5 and 4-6 respectively. Refer to Chapter 5, Figure 5-1, for test equipment setup. Note that all test measurements are taken at 25°C.

*Table 4-5. Receiver Performance Checks*

Test Name	Service Monitor	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON 4th channel test frequency* Monitor: Frequency error Input at RF In/Out	TEST MODE, Test Channel 4 carrier squelch out- put at antenna	PTT to continu- ous (during the performance check)	Frequency error to be ±200 Hz VHF ±600 Hz UHF ±60 Hz Low Band
Rated Audio	Mode: GEN Output level: 1.0mV RF 4th channel test frequency* Mod: 1kHz tone at 3kHz deviation Monitor: DVM: AC Volts	TEST MODE Test Channel 4 carrier squelch	PTT to OFF (center), meter selector to Audio PA	Set volume control to 3.16Vrms
Distortion	As above, except to distort- ion	As above	As above	Distortion 3.0% Typical
Sensitivity (SINAD)	As above, except SINAD, lower the RF level for 12dB SINAD.	As above	PTT to OFF (center)	RF input to be 0.25μV
Noise Squelch Threshold (only radios with conven- tional sys- tem need to be tested)	RF level set to 1mV RF	As above	PTT to OFF (center), meter selection to Audio PA, speaker/load to speaker	Set volume control to 3.16Vrms
	As above, except change fre- quency to a conventional system. Raise RF level from zero until radio unsquelches.	out of TEST MODE; select a conven- tional system	As above	Unsquelch to occur at <0.25μV. Preferred SINAD = 9-10dB

\* see Table 4-4

**Table 4-6. Transmitter Performance Checks**  
 (Models with "G" in location 10 of model number EX:LAH25KDF9**G**A3)

Test Name	Service Monitor	Radio	Test Set	Comments
Reference Frequency	Mode: PWR MON 4th channel test frequency* Monitor: Frequency error Input at RF In/Out	TEST MODE, Test Channel 4 carrier squelch	PTT to continuous (during the performance check)	Frequency error ±200 Hz VHF ±600 Hz UHF ±60 Hz Low Band
Power RF	As above	As above	As above	Refer to Specifications
Voice Modulation (internal)	Mode: PWR MON 4th channel test frequency* atten to -70, input to RF In/Out	TEST MODE, Test Channel 4 carrier squelch output at antenna	Remove modulation input	Press PTT switch on radio. Say "four" loudly into the radio mic. Measure deviation: VHF, UHF, 800MHz, Low 1 and Low 2: ≥ 4.0 kHz but ≤ 5.0 kHz (25 kHz Ch Sp)
Voice Modulation	Mode: PWR MON 4th channel test frequency* atten to -70, input to RF In/Out Monitor: DVM, AC Volts Set 1kHz Mod Out level for 0.025Vrms at test set, 80mVrms at AC/DC test set jack	As above	As above, meter selector to mic	Deviation: VHF, UHF, 800MHz, Low 1 and Low 2 ≥ 4.0 kHz but ≤ 5.0 kHz (25 kHz Ch Sp) Global. 5 kHz (20 kHz Ch Sp) U.S. and Canada.
High-Speed Data Modulation***	As above	TEST MODE, Test Channel 4 high speed output at antenna	PTT to continuous (during the performance check).	Deviation: 800MHz, VHF, UHF, Low 1 and Low 2: ≥ 2.5 kHz but ≤ 3.5 kHz (25 kHz Ch Sp)
Low-Speed Data Modulation 800,UHF	As above	TEST MODE, Test Channel 4 TLS output at antenna	PTT to continuous (during the performance check)	Deviation: VHF, UHF, 800MHz, : ≥500Hz but ≤ 1000Hz (25 kHz Ch Sp).
DTMF Modulation	As above, 4th channel test frequency*	TEST MODE, Test Channel 4 DTMF output at antenna	As above	Deviation: VHF, UHF, 800MHz, Low 1 and Low 2: ≥ 3.05 kHz but ≤ 3.45 kHz (25 kHz Ch Sp)
PL/DPL Modulation	As above 4th channel test frequency* BW to narrow	TEST MODE, Test Channel 4 TPL DPL	As above	Deviation: VHF, UHF, 800MHz, Low 1 and Low 2: ≥500Hz but ≤ 1000Hz (25 kHz Ch Sp).

\*\*\* MDC

\* See Table 4-4

## Chapter 5

# Radio Tuning, Programming, Cloning, and Lowband Antenna Cutting Procedure

### 5.1 Introduction

This chapter provides an overview of the Customer Programming Software (CPS) and tuner program designed for use in a Windows 95/98 environment. These programs are available in separate kits as listed in the Table 5-1. An installation instruction manual is also included with each kit.

**Note:** Refer to the appropriate program on-line help files for the programming procedures.

Table 5-1. Software Installation Kits Radio Tuning Setup

Description	Kit Number
CPS, Conventional and UHF Radios	HVN9027/H5197
CPS, 800MHz LTR	HVN9045
CPS, Privacy Plus	HVN9065
CPS, MPT Trunking Dealers	HVN9031

### 5.2 Global Radio Tuning Setup

A personal computer (PC), Windows 95/98, and a global tuner program are required to tune the radio. To perform the tuning procedures, the radio must be connected to the PC, radio interface box (RIB), and test equipment shown in Figure 5-1.

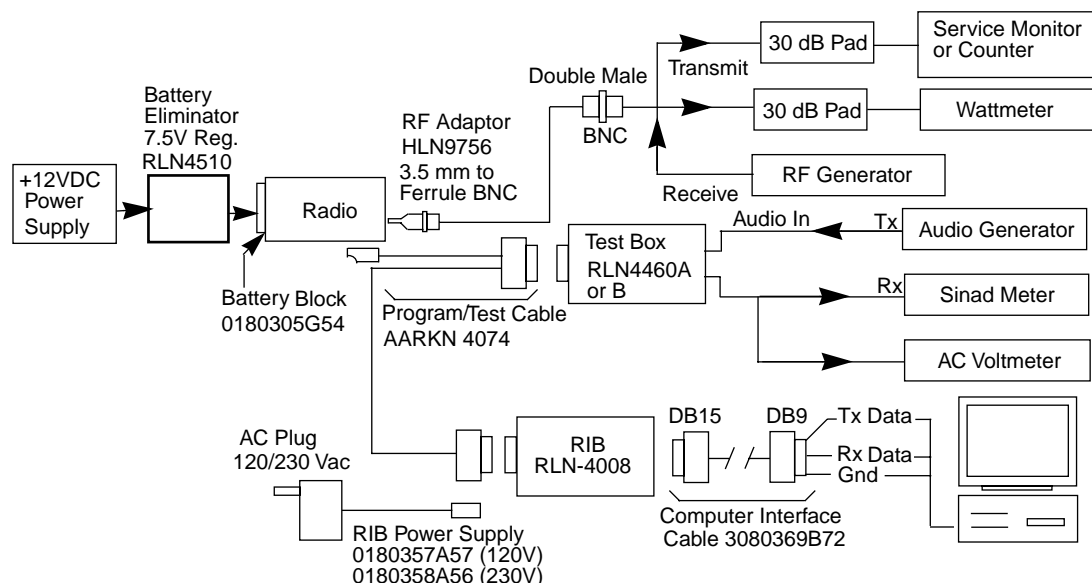


Figure 5-1. Radio Tuning Test Equipment Setup

### 5.2.1 Initial Test Equipment Setup

The supply voltage is connected to the radio using a Motorola battery eliminator, P/N AA0180305G54. The initial test equipment (Figure 5-1) control settings are listed in Table 5-2.

**Note:** Refer to appropriate program on-line help files for the tuning procedures.

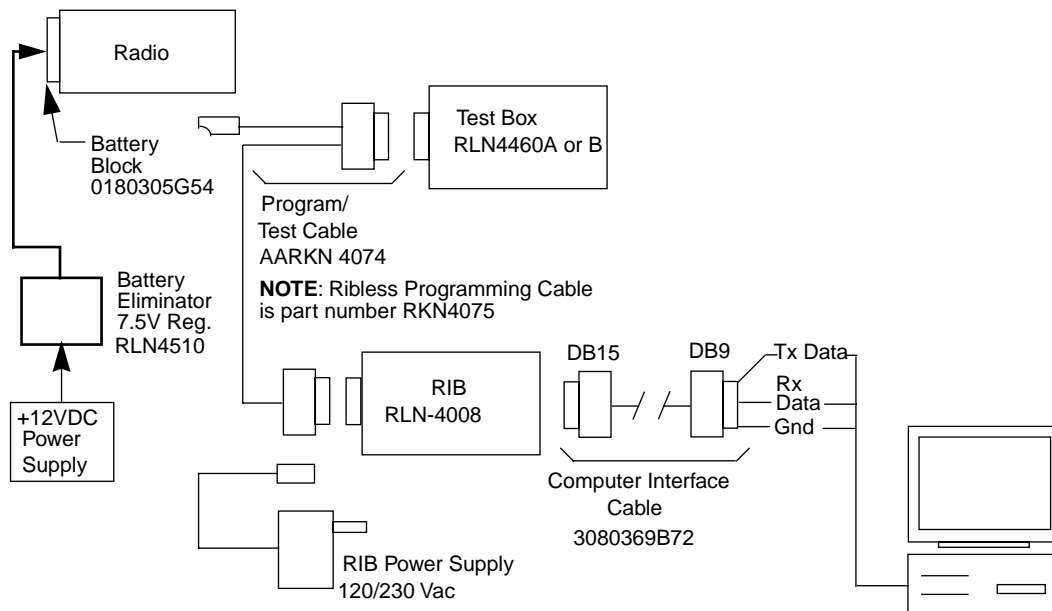
*Table 5-2. Initial Equipment Control Settings*

Service Monitor	Test Set	Power Supply
Monitor Mode: Power Monitor	Speaker set: A	Voltage: 7.5Vdc
RF Attenuation: -70	Speaker/load: Speaker	DC on/standby: Standby
AM, CW, FM: FM	PTT: OFF	Volt Range: 10V
Oscilloscope Source: Mod Oscilloscope Horizontal: 10mSec/Div Oscilloscope Vertical: 2.5kHz/Div Oscilloscope Trigger: Auto Monitor Image: Hi Monitor BW: Nar Monitor Squelch: mid CW Monitor Volume: 1/4 CW		Current: 2.5A

### 5.3 CPS Programming Setup

The CPS programming setup, shown in Figure 5-2, is used to program the radio codeplug.

**Note:** Refer to appropriate program on-line help files for the codeplug programming procedures.



*Figure 5-2. CPS Programming Setup*



## 5.4 Cloning (Conventional Only)

Cloning is the process of copying the content of one radio (source radio) into another radio (target radio). Radio content refers to system-type features such as frequency, squelch type options, trunking, etc.

**Note:** Cloning can be performed only on radios with identical model numbers and software options.

Radio functionality inherent in one radio cannot be cloned to another radio that does not contain the same functionality. Tuning and alignment information are not transferable and are not affected by cloning.

Signaling Identification Numbers (IDs) are duplicated in the cloning process. Unique IDs may be assigned with the CPS.

**Note:** Unsuccessful cloning attempts will not damage the radio.

Procedure:

1. Turn source and target radios off.
2. Connect cloning cable to side connector of both radios.
3. Turn on target radio.
4. On source radio, simultaneously press side buttons 1 and 2, shown in Figure 5-3, then turn radio on. Both radios produce a “clone-entry” tone and turn on their green LEDs. Display radios show “**Cloning To**” (source radio) and “**Program**” (target radio).
5. Release both side buttons. The electronic transfer process begins and will take approximately one to three minutes.
6. When cloning is completed, both radios reset themselves and turn their green LEDs off. The source radio produces a “clone-exit” tone and displays “**Clone Complete**”.
7. Turn both radios off.
8. Disconnect the cloning cable from both radios and turn them on for normal operation.

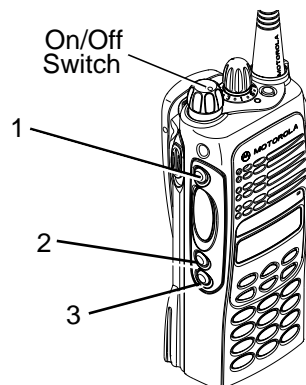


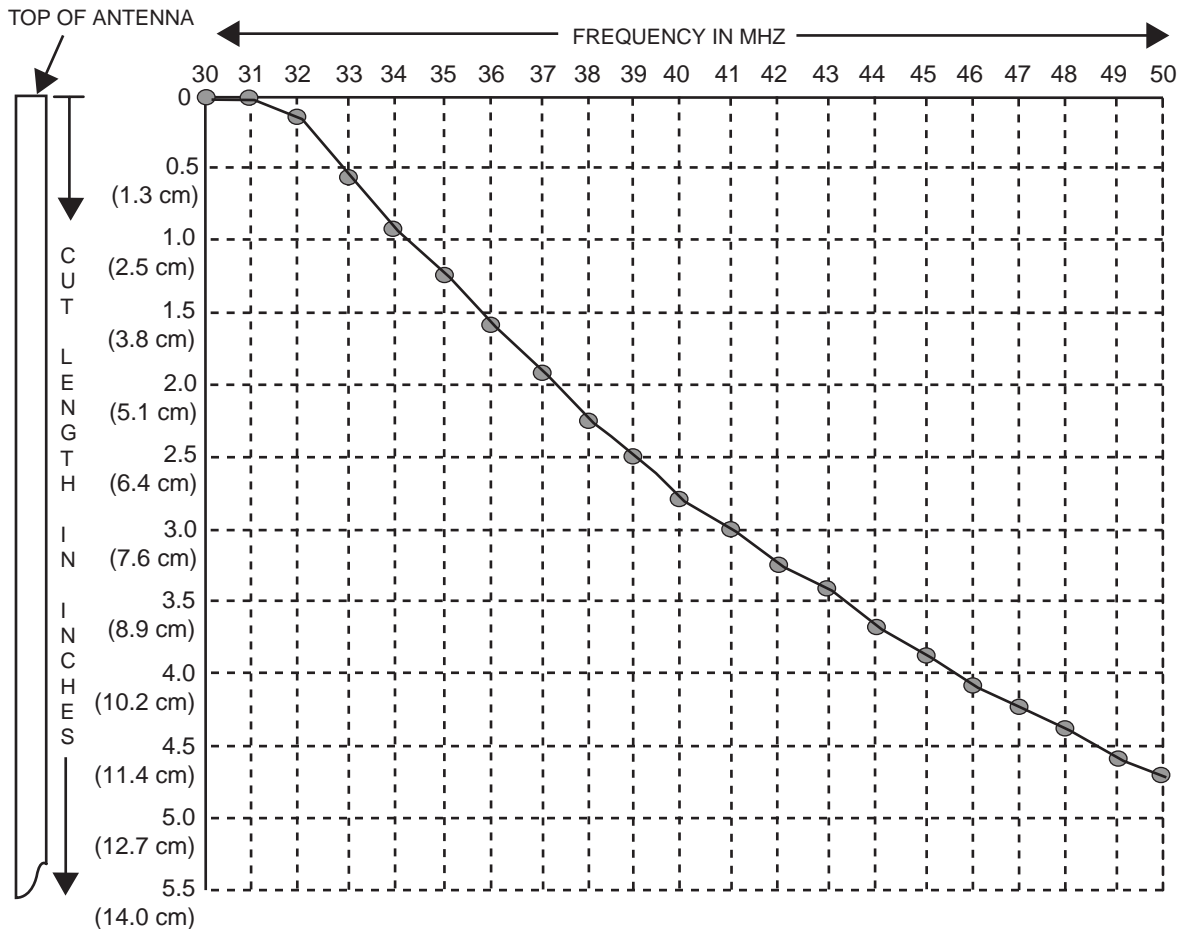
Figure 5-3. Radio Side Button Locations

### 5.4.1 Error Codes (Display Radios Only)

- “**ERR: Mismatch**” - The model numbers or the code plug versions are not the same for both radios. Cloning cannot be performed.
- “**ERR: Timeout**” - Communication between the two radios was not established or was disrupted during the cloning process. If this occurs, check the cloning cable and all connections. Repeat the cloning procedure.

## 5.5 Lowband Molded Antenna Cut Chart

This chart is for antenna NAB6064 used with professional radio series.



**Note:** The above chart is not drawn to scale. Obtain and use a standard ruler for marking of cutting measurements.

### Frequency Verification Chart

This chart can be used to verify the length or frequency of an antenna already cut. DO NOT use it to make the actual cut.

Freq (MHz)	Final Antenna Length (Inches)
30	11 9/16 (29.369 cm)
32	11 7/16 (29.052 cm)
34	10 5/8 (26.988 cm)
36	10 (25.400 cm)
38	9 3/8 (23.813 cm)
40	8 7/8 (22.543 cm)
42	8 5/16 (21.114 cm)
44	7 7/8 (20.003 cm)
46	7 1/2 (19.050 cm)
48	7 3/16 (18.256 cm)
50	6 7/8 (17.463 cm)

**Note:**

Antenna length measured from top of antenna to bottom of rubber skirt.

### Cutting Instructions

1. Remove cap from antenna.
2. Measure from top of antenna down to the desired length corresponding with the desired frequency.
3. Mark the antenna, then cut at that mark.
4. To replace the antenna cap, put a small bead of #414 Loctite™ (Motorola part number 1110019B59) around the inside walls of the antenna cap. Place the cap on top of the antenna and seat fully.

## Chapter 6

### Power Up Self-Test

#### 6.1 Error Codes - Conventional Radios

Turning on the radio starts a self-test routine that checks the RAM, ROM checksum, EEPROM hardware, and EEPROM checksum. If these checks are successful, the radio generates two high-pitched self-test pass tones, or a musical tone (selected in CPS). If the self-test is not successful, one low-pitched tone is heard. Radios with displays are able to display the error codes. The displayed error codes and related corrections are listed as follows:

*Table 6-1: Powe-up Display Codes - (Conventional Radios)*

If the error code displayed is...	then, there is a...	To correct the problem...
"RAM TST ERROR"	RAM test failure.	Retest the radio by turning it off and turning it on again. If message reoccurs, replace RAM (U405).
"ROM CS ERROR"	Wrong ROM checksum.	Reprogram FLASH memory, then retest. If message reoccurs, replace ROM (U406).
"EEPRM HW ERROR"	Codeplug structure mismatch or non existence of codeplug.	Reprogram codeplug with correct version and retest radio. If message reoccurs, replace EEPROM (U407).
"EEPRM CS ERROR"	Wrong codeplug checksum.	Reprogram codeplug.
No Display	Bad display module connection or damaged display module.	Check connection between main board and display module or replace with new display module.

#### 6.2 Error Codes

(For models with "G" in location 10 of model number. Example: LAH25UCH6GBAN)

At power-up, the radio performs cursory tests to determine if its basic electronics and software are in working order. Problems detected during these tests are presented as error codes on the radio display. The presence of an error code should prompt the user that a problem exists and that a service technician should be contacted.

Self-test errors are classified as either fatal or non-fatal. Fatal errors will inhibit user operation, non-fatal errors will not. Use Table 6-2: Power-up Display Codes to aid in understanding particular power-up error code displays.

*Table 6-2: Power-up Display Codes*

Failure Display	Type of Failure	Description	Possible Source
FAIL 01/81	FATAL	External ROM/Flash checksum error	Bad ROM data, Defective ROM
FAIL 01/82	FATAL	External EEPROM checksum error	Bad external codeplug data, Defective external EEPROM
ERROR 01/02	NON-FATAL	External EEPROM checksum error	Bad external codeplug data
FAIL 01/84	FATAL	External EEPROM checksum blank	Unprogrammed external codeplug data
FAIL 01/88	FATAL	External RAM error	Defective RAM
FAIL 01/90	FATAL	Hardware failure	Defective IC
FAIL 01/92	FATAL	Internal EEPROM checksum error	Bad internal codeplug data, Defective microcontroller
ERROR 01/12	NON-FATAL	Internal EEPROM checksum error	Bad internal codeplug data
FAIL 01/94	FATAL	Internal EEPROM checksum blank	Unprogrammed internal codeplug data
FAIL 01/98	FATAL	Internal RAM error	Defective microcontroller

**NOTE** Due to the nature of fatal ROM & RAM error, it may not be possible to present an error code on the display. In these cases the radio will attempt to display the appropriate error code, generate an illegal mode tone for one second and then reset its microcontroller.

## 6.3 Operation Display Codes

During radio operation, the radio performs dynamic tests to determine if the radio is working properly. Problems detected during these tests are presented as error codes on the radio display. The presence of an error code should prompt a user that a problem exists and that service technician should be contacted. Use Table 6-3 Operational Display Codes to aid in understanding particular operational error code displays.

**Table 6-3** Operational Display Codes

Failure Code	Description	Possible Source
FAIL 001	Synthesizer out of lock	Bad frequency data in codeplug, defective synthesizer
FAIL 002	Selected Mode (Zone/Channel) codeplug checksum error	Bad codeplug data

# Chapter 7

## Accessories

### 7.1 Antennas

<b>VHF</b>	<b>136 -174 MHz, Ferrule Connector</b>
PMAD4012	136 - 155 MHz, 9cm Stubby Red Code
PMAD4013	155 - 174 MHz, 9cm Stubby Black Code
PMAD4014	136 - 155 MHz, 14cm Standard Length Red Code
PMAD4015	155 - 174 MHz, 14cm Standard Length Black Code
PMAD4023	150 - 161 MHz
PMAD4025	150 - 161 MHz, Stubby
<b>UHF 1</b>	<b>403-470 MHz, Ferrule Connector</b>
PMAE4002	403-433 MHz
850476J08	433-470 MHz
NAE6483	403-520 MHz
<b>UHF 2</b>	<b>450-520 MHz, Ferrule Connector</b>
PMAE4006	470-510 MHz
PMAE4007	490-527 MHz
PMAE4008	470-530 MHz, Whip
NAE6483	403-520 MHz, Whip
NAB6064	(30-50 MHz) (whip)
<b>800 MHz</b>	<b>806-825/851-870 MHz, SMA Connector</b>
NAF5037	Antenna, Half Wave Whip (806-870 MHz)
NAF5042	Antenna, Quarter Wave, Stubby (806-870 MHz)

### 7.2 Carrying Accessories

HLN9714	Spring 2-1/2" Belt Clip
HLN9844	Spring 1-1/2" Belt Clip
NTN5243	Shoulder Strap for All Carry Cases (HLN9149 is Required when used with Nylon Carry Case.)
HLN9952	Carry Holder, Belt Clip

### 7.3 Carry Cases

<b>PRO5150, PRO7150, PRO5350, PRO7350, PRO5450, PRO7450</b>	<b>Ultra-High and High Capacity Battery Carry Cases (Standard Battery), Lithium Ion Battery Carry Cases (Thin Battery)</b>
HLN9652	Standard Leather Case, Short, Plain, Beltloop, Thin Battery
HLN9665	Standard Leather Case, Short, Plain, Beltloop, Standard Battery
HLN9670	Standard Leather Case, Short, Plain, Swivel, Thin Battery
HLN9676	Standard Leather Case, Short, Plain, Swivel, Standard Battery
HLN9677	Standard Leather Case, Short, DTMF, Beltloop, Thin Battery
HLN9689	Standard Leather Case, Short, DTMF, Beltloop, Standard Battery
HLN9690	Standard Leather Case, Short, DTMF, Swivel, Thin Battery
HLN9694	Standard Leather Case, Short, DTMF, Swivel, Standard Battery
<b>PRO9150, PRO9450</b>	<b>Ultra-High and High Capacity Battery Carry Cases (Standard Battery), Lithium Ion Battery Carry Cases (Thin Battery)</b>
HLN9695	Standard Leather Case, Tall, DTMF, Beltloop, Thin Battery
HLN9698	Standard Leather Case, Tall, DTMF, Beltloop, Standard Battery
HLN9699	Standard Leather Case, Tall, DTMF, Swivel, Thin Battery
HLN9700	Standard Leather Case, Tall, DTMF, Swivel, Standard Battery
HLN9701	Nylon Carry Case DTMF

### 7.4 Chargers

AAHTN3000	120V Rapid Rate Single Unit Charger, U.S. 3-Prong Plug
AAHTN3001	230V Rapid Rate Single Unit Charger, Euro 2-Prong Plug
AAHTN3002	230V Rapid Rate Single Unit Charger, UK 3-Prong Plug
HTN3032	230V Rapid Rate Single Unit Charger, Argentina Plug
AAHTN3003	120V Multi-Unit Rapid Rate Charger, U.S. 3-Prong Plug
AAHTN3004	230V Multi-Unit Rapid Rate Charger, Euro 2-Prong
AAHTN3005	230V Multi-Unit Rapid Rate Charger, UK 3-Prong
EPNN5751	120V Transformer, U.S. Plug
25-04548T05	120V Transformer Only
EPNN5752	230V Transformer, Euro Plug
25-04548T07	230V Euro Transformer Only
EPNN5753	230V Transformer, UK Plug
25-04548T06	230V UK Transformer Only

EPNN6319	230V Transformer, Argentine Plug
25-04548T11	230V Argentina Transformer Only
HLN9793	Charger Spacer, Adhesive
HLN9794	Charger Spacer, Snap-In
HLN9820	Dust Cover
HTN9000	Rapid Rate Single Unit (Pocket Only)
NLN7967	Mount, Wall Kit for Multi-unit Charger

## 7.5 Batteries

HNN9008	NiMH High Capacity Battery (Standard With Unit)
HNN9009	NiMH Ultra High Capacity Battery
HNN9010	NiMH Ultra High Capacity Battery Factory Mutual
HNN9011	Ni-Cd High Capacity Battery Factory Mutual
HNN9012	Ni-Cd High Capacity Battery
HNN9013	Lithium Ion High Capacity Battery (Thin)
HNN9013	Lithium Ion High Capacity Battery

## 7.6 Adaptors

AAHLN9716	GP300 Audio Accessory Adaptor
AAHLN9717	3.5mm Audio Accessory Adaptor

## 7.7 Miscellaneous

HLN9820	Dust Cover for Accessory Connector
HLN9793	Charger Insert Spacer (Compatible with "A" Version Charges Only)
HLN9794	Charger Insert Spacer (Compatible with "B" Version Charges Only)

## 7.8 Service Aids

AARKN4073	Cloning Cable, portable Professional Radio Only
AARKN4074	PROGRAMMING/Test Cable
AARKN4075	Programming cable (includes internal Rib)
0180305G54	Shop battery eliminator cable. Requires RLN4510A (7.5 volt source)
RLN4510	7.5 Volt Universal Battery Eliminator
AA8180384F68	Bench test housing eliminator/test fixture. Requires RLN4510A 7.5V
HLN9756	Ferrule to BNC adapter
RLN4460	Test Box

HLN9742	Flash Upgrade Kit for MPT
HVN9027	CPS in CD for Conventional
HVN9045	CPS in CD for 800MHZ LTR (Programmable cable must be ordered separately)
HVN9030	MPT Network CD
HVN9031	MPT Dealer CD
HVN9014	Tuner Program Diskette

## 7.9 Audio Accessories

AARMN4017	Ultra-Lightweight Headset with Microphone
AARMN4018	Lightweight Headset with Swivel Boom Microphone
AARMN4019	Medium Weight Dual Muff Headset, Over the Head
AARMN4020	Heavy Duty Behind the Head Headset with Noise Cancelling Boom Microphone and PTT
AARMN4021	Ear Piece without Volume Control (Beige)
AARMN4022	Ear Piece with Microphone and PTT (Beige)
AARMN4028	Ear Piece without Volume Control (Black)
AARMN4029	Ear Piece with Microphone and PTT (Black)
HMN9754	Two piece surveillance microphone for 800MHZ

**The following accessories require adapter AAHLN9716:**

BDN6646	Temco Ear Microphone (PRO3150 only)
BDN6647	Lightweigh Headset Single Muff
BDN6648	Behind Head Medium Weight Noise Cancelling
BDN6706	Ear Microphone with VOX
BDN6720	Flexible Ear Receiver
HMN9022	Behind the Head Medium Weight Headset Dual Muff
HMN9725R	Microphone, Remote Speaker
HMN9752	Earpiece with Volume Control
HMN9787	Headset w/Boom Microphone

**The following accessories require adapter AAHLN9717:**

BDN6664	Earpiece with 4.7K Z Earpiece (Beige)
BDN6726	Earpiece with 4.7K Z Earpiece (Black)
BDN6665	Earpiece with Extra Loud 1.8KΩ (Beige)
BDN6727	Earpiece with Extra Loud 1.8KΩ (Black)



BDN6666	Earpiece with Volume Control Standard (Beige)
BDN6728	Earpiece with Volume Control Standard (Black)
BDN6667	Two wire PTT/mic +Earpiece (Beige)
BDN6729	Two wire PTT/mic +Earpiece (Black)
BDN6669	Two wire PTT/mic +Earpiece Extra Loud (Beige)
BDN6731	Two wire PTT/Mic +Earpiece Extra Loud (Black)
BDN6668	Three Wire Lapel Mic/Earpiece/PTT (Beige)
BDN6730	Three Wire Lapel Mic/Earpiece/PTT (Black)
HMN9787	Headset w/Boom Microphone

## 7.10 Option Boards\*

AAHLN9729	DTMF Decode Option Board with Manual
6881088C24	DTMF Decode Installation Sheet
AAHLN9725	Voice Storage Option Board with Manual
6881088C22	Voice Storage User Manual

\*All option boards include the installation.user manual.

## 7.11 Remote Speaker Microphones

HMN9030	Remote Speaker Microphone w/Coiled Cord and Clip Back. (Requires AAHLN9716 Adapter)
AAHMN9052	Remote Speaker Standard Microphone
AAPMMN4002	Temco™ Remote Speaker Microphone with Noise Cancelling
AAHMN9053	Remote Speaker Noise Cancelling Microphone
AAHMN9054	Remote Speaker Public Safety Microphone
AAHKN9055	Replacement Cable for Standard and Noise Cancelling
6881088C12	Remote Speaker Microphone Instruction Sheet
6881088C18	Public Safety Microphone Instruction Sheet
6881090C49	Temco™ Remote Speaker Microphone User Manual
AARLN4885A	Receive Only Earbud (for use with AAHMN9053 and AAHMN9054 Remote Speaker Microphone)

## 7.12 Manuals

6881088C38	User Guide, PRO7150 Conv/MDC, Spanish/Portuguese/English
6881089C96	User Guide, PRO5150 Conv/MDC, Spanish/Portuguese/English
6881089C99	User Guide, PRO9150 Conv/MDC, Spanish/Portuguese/English

6881088C39	User Guide, PRO5450 MPT, Spanish/Portuguese/English
6881091C15	User Guide, PRO7450 MPT, Spanish/Portuguese/English
6881088C40	User Guide, PRO5350 LTR, Spanish/Portuguese/English
6881088C43	User Guide, PRO7350 LTR, Spanish/Portuguese/English
6881093C85	User Guide, PRO5550/5650 Privacy Plus, Spanish/Portuguese/English
6881093C86	User Guide, PRO7550/7650 Privacy Plus, Spanish/Portuguese/English
6881088C47	Service Manual, Level 1 and 2, Basic, Spanish
6881088C49	Service Manual, Level 1 and 2, Basic, Portuguese
6881088C45	Service Manual, Level 1 and 2, Basic, English
6881088C48	Service Manual, VHF/UHF Level 3 Detailed, Spanish
6881088C50	Service Manual, VHF/UHF Level 3 Detailed, Portuguese
6881088C46	Service Manual, VHF/UHF Level 3 Detailed, English
6881089C15	FM Supplement USA, Canada, and Latin America

### 7.13 Retrofit Front Cover Kits

HLN9987	DTMF Retrofit Kit for PRO5150 model only
HLN9988	DTMF Retrofit Kit for PRO5350 model only

## Chapter 8

### Model Chart and Test Specifications

#### 8.1 UHF 403-470 MHz

PRO Series, UHF, 403-470 MHz					
Model					Description
	LAH25RDC9AA2				PRO5150, 403-470 MHz, 4W, 4-Ch (4-Frequency)
		LAH25RDC9AA3			PRO5150, 403-470 MHz, 4W, 16-Ch
			LAH25RDH9AA6		PRO7150, 403-470 MHz, 4W, 128-Ch
			LAH25RDN9AA8		PRO9150, 403-470 MHz, 4W, 160-Ch
				Item	Description
X				PMLE4171	PRO5150 Back Cover Kit (4-Frequency)
	X			PMLE4130	PRO5150 Back Cover Kit
		X		PMLE4109	PRO7150 Back Cover Kit
			X	PMLE4132	PRO9150 Back Cover Kit
X	X			PMLN4348	PRO5150 Front Housing Kit
		X		PMLN4199	PRO7150 Front Housing Kit
			X	PMLN4041	PRO9150 Front Housing Kit
X	X	X	X	NAE6483	Antenna, Whip, 403-520 MHz
X	X			68P81089C96	PRO5150 User Guide
		X		68P81088C38	PRO7150 User Guide
			X	68P81089C99	PRO9150 User Guide

x = Indicates one of each is required.

## 8.2 UHF 450-527 MHz

PRO Series, UHF, 450-527 MHz					
Model				Description	
LAH25SDC9AA2				PRO5150, 450-527 MHz, 4W, 4-Ch (4-Frequency)	
LAH25SDC9AA3				PRO5150, 450-527 MHz, 4W, 16-Ch	
LAH25SDH9AA6				PRO7150, 450-527 MHz, 4W, 128-Ch	
LAH25SDN9AA8				PRO9150, 450-527 MHz, 4W, 160-Ch	
				Item	Description
X				PMLE4172	PRO5150 Back Cover Kit (4-Frequency)
	X			PMLE4118	PRO5150 Back Cover Kit
		X		PMLE4119	PRO7150 Back Cover Kit
			X	PMLE4121	PRO9150 Back Cover Kit
X	X			PMLN4348	PRO5150 Front Housing Kit
		X		PMLN4199	PRO7150 Front Housing Kit
			X	PMLN4218	PRO9150 Front Housing Kit
X	X	X	X	NAE6483	Antenna, Whip, 403-520 MHz
X	X			68P81089C96	PRO5150 User Guide
		X		68P81088C38	PRO7150 User Guide
			X	68P81089C99	PRO9150 User Guide

x = Indicates one of each is required.

### 8.3 UHF 403-470 MHz (MPT)

PRO Series, UHF, 403-470 MHz (MPT)				
Model			Description	
LAH25RDC9CK3			PRO5450, 403-470 MHz, 4W, 16-Ch	
LAH25RDH9CK6			PRO7450, 403-470 MHz, 4W, 128-Ch	
LAH25RDN9CK8			PRO9450, 403-470 MHz, 4W, 160-Ch	
			Item	Description
X			PMLE4133	PRO5450 Back Cover Kit
	X		PMLE4134	PRO7450 Back Cover Kit
		X	PMLE4136	PRO9450 Back Cover Kit
X			PMLN4303	PRO5450 Front Housing Kit
	X		PMLN4304	PRO7450 Front Housing Kit
		X	PMLN4305	PRO9450 Front Housing Kit
X	X	X	NAE6483	Antenna, Whip, 403-520 MHz
X			68P81089C39	PRO5450 User Guide
	X		68P81091C15	PRO7450 User Guide
		X	68P81091C17	PRO9450 User Guide

x = Indicates one of each is required.

## 8.4 UHF 450-527 MHz (MPT)

PRO Series, UHF, 450-527 MHz (MPT)				
Model			Description	
LAH25SDN9CK3			PRO5450, 450-527 MHz, 4W, 16-Ch	
	LAH25SDC9CK6		PRO7450, 450-527 MHz, 4W, 128-Ch	
	LAH25SDN9CK8		PRO9450, 450-527 MHz, 4W, 160-Ch	
		Item	Description	
X		PMLE4122	PRO5450 Back Cover Kit	
	X	PMLE4123	PRO7450 Back Cover Kit	
	X	PMLE4127	PRO9450 Back Cover Kit	
X	X	PMLN4216	PRO5450 Front Housing Kit	
	X	PMLN4199	PRO7450 Front Housing Kit	
	X	PMLN4218	PRO9450 Front Housing Kit	
X	X	NAE6483	Antenna, Whip, 403-520 MHz	
X		68P81089C39	PRO5450 User Guide	
	X	68P81091C15	PRO7450 User Guide	
	X	68P81091C17	PRO9450 User Guide	

x = Indicates one of each is required.

## 8.5 UHF 403-470 MHz (LTR)

PRO Series, UHF, 403-470 MHz (LTR)				
Model			Description	
LAH25RDC9DU3			PRO5350, 403-470 MHz, 4W, 16-Ch	
	LAH25RDH9DU6		PRO7350, 403-470 MHz, 4W, 128-Ch	
		Item	Description	
X		PMLE4148	PRO5350 Back Cover Kit	
	X	PMLE4149	PRO7350 Back Cover Kit	
X		PMLN4216	PRO5350 Front Housing Kit	
	X	PMLN4199	PRO7350 Front Housing Kit	
X	X	NAE6483	Antenna, Whip, 403-520 MHz	
X		68P81088C40	PRO5350 User Guide	
	X	68P81088C43	PRO7350 User Guide	

x = Indicates one of each is required.

## 8.6 UHF 450-527 MHz (LTR)

PRO Series, UHF, 450-527 MHz (LTR)				
Model			Description	
LAH25SDC9DU3			PRO5350, 450-527 MHz, 4W, 16-Ch	
LAH25SDH9DU6			PRO7350, 450-527 MHz, 4W, 128-Ch	
		Item	Description	
X		PMLE4150	PRO5350 Back Cover Kit	
	X	PMLE4151	PRO7350 Back Cover Kit	
X		PMLN4216	PRO5350 Front Housing Kit	
	X	PMLN4199	PRO7350 Front Housing Kit	
X	X	NAE6483	Antenna, Whip, 403-520 MHz	
X		68P81088C40	PRO5350 User Guide	
	X	68P81088C43	PRO7350 User Guide	

x = Indicates one of each is required.

## 8.7 VHF 136-174 MHz

PRO Series, VHF, 136-174 MHz				
Model			Description	
LAH25KDC9AA2			PRO5150, 136-174 MHz, 5W, 4 -Ch (4-Frequency)	
LAH25KDC9AA3			PRO5150, 136-174 MHz, 5W, 16 -Ch	
LAH25KDH9AA6			PRO7150, 136-174 MHz, 5W, 128 -Ch	
LAH25KDN9AA8			PRO9150, 136-174 MHz, 5W, 160 -Ch	
		Item	Description	
X		PMLD4159	PRO5150 Back Cover Kit (4-Frequency)	
	X	PMLD4109	PRO5150 Back Cover Kit	
		X	PMLD4110	PRO7150 Back Cover Kit
		X	PMLD4112	PRO9150 Back Cover Kit
X	X	PMLN4348	PRO5150 Front Housing Kit	
		X	PMLN4199	PRO7150 Front Housing Kit
		X	PMLN4401	PRO9150 Front Housing Kit
X	X	X	PMAD4023	Antenna, Whip, 150-161 MHz
X	X	X	PMAD4014	Antenna, 136-155 MHz 14 cm
X	X	X	PMAD4015	Antenna, 155-174 MHz 14 cm
X	X		68P81089C96	PRO5150 User Guide

x = Indicates one of each is required.

<b>PRO Series, VHF, 136-174 MHz</b>				
<b>Model</b>			<b>Description</b>	
	X		68P81088C38	PRO7150 User Guide
		X	68P81089C99	PRO9150 User Guide

x = Indicates one of each is required.

## 8.8 Low Band 29.7-42/35-50MHz

<b>PRO Series, Lowband, 29.7- 42/35 - 50MHz</b>				
<b>Model</b>			<b>Description</b>	
LAH25BEC9AA3			PRO5150, 29.7-42 MHz, 6W, 16 -Ch	
LAH25CEC9AA3			PRO5150, 35-50 MHz, 6W, 16 -Ch	
		<b>Item</b>	<b>Description</b>	
X		PMLB4002	PRO5150 Back Cover Kit, 29.7-42 MHz	
	X	PMLB4010	PRO5150 Back Cover Kit, 35-50 MHz	
X	X	PMLN4216	PRO5150 Front Housing Kit	
X	X	NAB6064	Antenna, Molded, Cut to Frequency	
X		68P81089C96	PRO5150 User Manual	

x = Indicates one of each is required.

## 8.9 800 MHz (LTR)

<b>PRO Series, 806-870 MHz (LTR)</b>				
<b>Model</b>			<b>Description</b>	
LAH25UCC6DU3			PRO5350, 806-870MHz, 2.5W, 16-Ch	
LAH25UCH6DU6			PRO7350, 806-870MHz, 2.5W, 128-Ch	
		<b>Item</b>	<b>Description</b>	
X		PMLF4012	PRO5350 Back Cover Kit	
	X	PMLF4013	PRO7350 Back Cover Kit	
X		PMLN4216	PRO5350 Front Housing Kit	
	X	PMLN4199	PRO7350 Front Housing Kit	
X	X	NAF5037	Antenna, Whip	
X	X	NAF5042	Antenna, Quarter Wave, Stubby, 806-870 MHz	
X		68P81088C40	PRO5350 User Guide	
	X	68P81088C43	PRO7350 User Guide	

x = Indicates one of each is required.



## 8.10 800 MHz (Privacy Plus)

800 MHz					
Model					Description
LAH25UCC6GC3	LAH25UCH6GC6	LAH25UCC6GB3	LAH25UCH6GB6		PRO5550, 800 MHz 2.5W Non-Display
					PRO7550, 800 MHz 2.5W Display
					PRO5650, 800 MHz 2.5W Non-Display
			PRO7650, 800 MHz 2.5W Display		
				Item	Description
X		X		PMUF1046	PRO5550/PRO5650 Super Tanapa 800 MHz 2.5W
	X		X	PMUF1047	PRO7550/PRO7650 Super Tanapa 800 MHz 2.5W
X		X		PMUF1048	PRO5550/PRO5650 Tanapa 800 MHz 2.5W
	X		X	PMUF1049	PRO7550/PRO7650 Tanapa 800 MHz 2.5W
X		X		PMLF4016	PRO5550/PRO5650 B/C Kit 800 MHz 2.5W
	X		X	PMLF4017	PRO7550/PRO7650 B/C Kit 800 MHz 2.5W
X		X		PMLN4216	PRO5550/PRO5650 Front Housing Kit
	X		X	PMLN4373	PRO7550/PRO7650 Front Housing Kit
X	X	X	X	NAF5037A	800 MHz Whip Antenna
X	X	X	X	NAF5042AR	800 MHz 1/4 Wave Stubby Antenna
X	X			6881093C85	PRO5550/PRO5650 User Guide (English/Spanish/Portuguese)
		X	X	6881093C86	PRO7550/PRO7650 User Guide (English/Spanish/Portuguese) )

x = Indicates one of each is required.

## 8.11 Specifications - PRO5150/PRO5350/PRO5450 Radios

General		
Specification	Lowband	VHF/UHF
Model Numbers:	LAH25BEC LAH25CEC	VHF/LAH25KDC UHF/LAH25RDC UHF/LAH25SDC
Frequency Range:	29.7 - 42.0 MHz 35.0- 50.0 MHz	VHF/136-174 MHz UHF/403 - 470 MHz UHF/450 - 527 MHz
Frequency Stability (-30°C to +60°C, 25°C Ref.)	±10 PPM	±5 PPM @ 25 KHZ ±2.5 PPM @ 12.5 KHZ
Channel Capacity:	16 Channels	4 or 16 Channels/1 system/16 talkgroups
Channel Spacing:	20 kHz	12.5/20/25 kHz
Power Supply:	7.5 volts rechargeable battery	

General		
Specification	Lowband	VHF/UHF
Dimensions(Height x Width x Depth): With Standard High Capacity NiMH Battery (without Belt Clip):  With Ultra High Capacity NiMH Battery (without BeltClip):	5.40 in. x 2.26 in. x 1.50 in. 137mm x 57.5mm x 37.5mm  5.40 in. x 2.26 in. x 1.55 in. 137mm x 57.5mm x 40mm	
Weight: With Standard High Capacity NiMH Battery (grams/ ounces):  With Ultra High Capacity NiMH Battery (grams/ounces):	420/15  500/16	
Average Battery Life @ (5-5-90 Duty Cycle*): Standard High Capacity NiMH Battery:  Ultra High Capacity NiMH Battery:	>11 hrs @ low power/8 hrs @ high power  >14 hrs @ low power/11 hrs @ high power	
Sealing:	Passes rain testing per IP54 and MIL-STD 810E	
Shock:	Meets MIL-STD-810-C,D & E and TIA/EIA 603	
Vibration:	Meets MIL-STD-810-C,D & E and TIA/EIA 603	
Dust:	Meets MIL-STD-810-C,D & E and IP54	
Humidity:	Meets MIL-STD-810-C,D & E and TIA/EIA 603	

\* 5% receive, 5% transmit, 90% standby

Transmitter		
Specification	Lowband	VHF/UHF
Power Output NiMH @ 7.5V:	1-6 W	VHF/1-5 W UHF/1-4 W
Spurs/Harmonics:	-36 dBm < 1GHz -30 dBm > 1 GHz	
Audio Response: (from 6 dB/oct. Pre-Emphasis, 300 to 3000Hz)	+1 to -3 dB	
Audio Distortion: @ 1000 Hz, 60% Rated Max. Dev.	3% Typical	
Modulation Limiting:	±5.0 kHz @ 20 kHz	±2.5 kHz @ 12.5 kHz ±4.0 kHz @ 20 kHz ±5.0 kHz @ 25 kHz
Conducted/Radiated Emissions:	66 dBw	
FM Hum and Noise:	-40 dB	

Receiver		
Specification	Lowband	VHF/UHF
Sensitivity (12 dB SINAD) EIA:	0.25 $\mu$ V Typical	
Sensitivity (20 dB SINAD) ETS:	0.5 $\mu$ V Typical	
Intermodulation per EIA:	70 dB	
Adjacent Channel Selectivity ETS:	70 dB	60 dB @ 12.5 kHz 70 dB @ 25 kHz
Spurious Rejection:	70 dB	
Rated Audio:	0.5 W	
Audio Distortion @ Rated Audio:	3% Typical	
Hum and Noise:	-45 dB @ 12.5 kHz/-50 dB @ 25/30 kHz	
Audio Response (0.3 - 3 kHz):	+1 to -3 dB	
Conducted Spurious Emission per FCC Part 15:	-57 dBm <1 Ghz -47 dBm >1 Ghz	

Specifications subject to change without notice. All electrical specifications and methods refer to EIA/TIA 603 standards. PRO Series radios meet or exceed requirements of MIL STD 810 C, D, E.

## 8.12 Specifications - PRO7150/PRO7350/PRO7450 Radio

General		
Specification	VHF	UHF
Model Numbers:	LAH25KDH	LAH25RDH LAH25SDH
Frequency Range:	136-174 MHz	403 - 470 MHz 450 - 527 MHz
Frequency Stability (-30°C to +60°C, 25°C Ref.)	±5 PPM @ 25 KHZ ±2.5 PPM @ 12.5 KHZ	
Channel Capacity:	128 Channels/15 Systems/16 Talk Groups	
Channel Spacing:	12.5/20/25 kHz	
Power Supply:	7.5 volts rechargeable battery	
Dimensions (Height x Width x Depth): With Standard High Capacity NiMH Battery; without Belt Clip:	5.40 in. x 2.26 in. x 1.50 in. 137mm x 57.5mm x 37.5mm	
With Ultra High Capacity NiMH Battery; without Belt Clip:	5.40 in. x 2.26 in. x 1.55 in. 137mm x 57.5mm x 40mm	
Weight: With Standard High Capacity NiMH Battery (grams/ounces):	420/15	
With Ultra High Capacity NiMH Battery (grams/ounces):	500/16	
Average Battery Life @ (5-5-90 Duty Cycle*): Standard High Capacity NiMH Battery:	>11 hrs @ low power/8 hrs @ high power	
Ultra High Capacity NiMH Battery:	>14 hrs @ low power/11 hrs @ high power	
Sealing:	Passes rain testing per IP54 and MIL-STD 810E	
Shock:	Meets MIL-STD-810-C,D & E and TIA/EIA 603	
Vibration:	Meets MIL-STD-810-C,D & E and TIA/EIA 603	
Dust:	Meets MIL-STD-810-C,D & E and IP54	
Humidity:	Meets MIL-STD-810-C,D & E and TIA/EIA 603	

\* 5% receive, 5% transmit, 90% standby

Transmitter		
Specification	VHF	UHF
Power Output NiMH @ 7.5V:	1-5 W	1-4 W
Spurs/Harmonics:	-36 dBm < 1GHz -30 dBm > 1 GHz	
Audio Response: (from 6 dB/oct. Pre-Emphasis, 300 to 3000Hz)	+1 to -3 dB	
Audio Distortion: @ 1000 Hz, 60% Rated Max. Dev.	3% Typical	
Modulation Limiting:	±2.5 kHz @ 12.5 kHz ±4.0 kHz @ 20 kHz ±5.0 kHz @ 25 kHz	
Conducted/Radiated Emissions:	66 dBw	
FM Hum and Noise:	-40 dB	

Receiver		
Specification	VHF	UHF
Sensitivity (12 dB SINAD) EIA:	0.25 $\mu$ V Typical	
Sensitivity (20 dB SINAD) ETS:	0.5 $\mu$ V Typical	
Intermodulation per EIA:	70 dB	
Adjacent Channel Selectivity ETS:	60 dB @ 12.5 kHz 70 dB @ 25/30 kHz	60 dB @ 12.5 kHz 70 dB @ 25 kHz
Spurious Rejection:	70 dB	
Rated Audio:	0.5 W	
Audio Distortion @ Rated Audio:	3% Typical	
Hum and Noise:	-50 dB @ 30 kHz	-45 dB @ 12.5 kHz -50 dB @ 25/30 kHz
Audio Response (0.3 - 3 kHz):	+1 to -3 dB	
Conducted Spurious Emission per FCC Part 15:	-57 dBm <1 Ghz -47 dBm >1 Ghz	

Specifications subject to change without notice. All electrical specifications and methods refer to EIA/TIA 603 standards. PRO Series radios meet or exceed requirements of MIL STD 810 C, D, E.

## 8.13 Specifications - PRO9150/PRO9450 Radio

Data is specified for +25°C unless otherwise stated.

General		
Specifications	MPT	VHF/UHF
Model Numbers:	LAH25RDN9CK8 LAH25SDN9CK8	LAH25KDN9AA8 (VHF) LAH25RDN9AA8 (UHF) LAH25SDN9AA8 (UHF)
Frequency Range:	403-407 MHz (UHF) 450-527 MHz (UHF)	136-174 MHz (VHF) 403-470 MHz (UHF) 450-527 MHz (UHF)
Channel Capacity	160 Conventional, Continuous Rotary	
Power Supply	Rechargeable battery 7.5v	
Dimensions: H x W x D (mm) With standard high capacity NiMH battery With ultra high capacity NiMH battery With NiCD battery With Lilon battery	Height excluding knobs 152 x 57.5 x 37.5 152 x 57.5 x 40.0 152 x 57.5 x 40.0 152 x 57.5 x 33.0	
Weight: (gm) With Standard high capacity NiMH battery With Ultra high capacity NiMH battery With NiCD battery With Lilon battery	460 535 485 390	
Average Battery Life @5/5/90 Cycle: With Standard high capacity NiMH battery With Ultra high capacity NiMH battery With NiCD battery With Lilon battery	<b>Low Power</b> 11 hours 14 hours 12 hours 11 hours	<b>High Power</b> 8 hours 11 hours 9 hours 8 hours
Sealing:	Withstands rain testing per MIL STD 810 C/D /E and IP54	
Shock and Vibration:	Protection provided via impact resistant housing exceeding MIL STD 810-C/D /E and TIA/EIA 603	
Dust and Humidity:	Protection provided via environment resistant housing exceeding MIL STD 810 C/D /E and TIA/EIA 603	

Transmitter	
Specification	VHF/UHF
Channel Spacing	12.5/20/25 kHz
Frequency Stability (-25°C to +55°C, +25° Ref.)	±2.5 ppm
Power	VHF: 1-5W UHF: 1-4W
Modulation Limiting	±2.5 @ 12.5 kHz ±4.0 @ 20 kHz ±5.0 @ 25 kHz
FM Hum & Noise	-40 dB typical
Conducted/Radiated Emission	-66 dBm
Adjacent Channel Power	-60 dB @ 12.5 kHz -70 dB @ 20/25 kHz
Audio Response (300 - 3000 Hz)	+1 to -3 dB
Audio Distortion	3%

Receiver	
Specification	VHF/UHF
Channel Spacing	12.5/20/25 kHz
Frequency Stability (-25°C to +55°C, +25° Ref.)	±2.5 ppm
Sensitivity (12 dB SINAD) EIA Sensitivity (20 dB SINAD) ETS	.25 µV typical .50 µV typical
Intermodulation EIA	70 dB
Adjacent Channel Selectivity	60 dB @ 12.5 kHz / 70 dB @ 20/25 kHz
Spurious Rejection	70 dB
Rated Audio	0.5W
Audio Distortion @ Rated Audio	3% typical
Hum & Noise	-45 dB @ 12.5 kHz -50 dB @ 20/25 kHz
Audio Response (300 - 3000 Hz)	+1 to -3 dB
Conducted Spurious Emission per FCC Part 15	-57 dBm <1 GHz -47 dBm >1 GHz

Specifications subject to change without notice. All electrical specifications and methods refer to EIA/TIA 603 standards. PRO Series radios meet or exceed requirements of MIL STD 810 C, D, E.

## 8.14 Specifications - 800MHz Radio

General		
Specification	800 MHz	
Frequency:	806-821, 851-866 MHz	
Channel Capacity:	PRO5350: 1 System/16 Talk Groups PRO7350: 15 Systems/16 Talk Groups	
Power Supply:	7.5 Volts $\pm$ 20%	
Dimensions (Height x Width x Depth): With Standard High Capacity NiMH Battery; without Belt Clip:	5.40 in. x 2.26 in. x 1.50 in. 137mm x 57.5mm x 37.5mm	
With Ultra High Capacity NiMH Battery; without Belt Clip:	5.40 in. x 2.26 in. x 1.55 in. 137mm x 57.5mm x 40mm	
Weight: with Standard High Capacity NiMH Battery:	420 g	
with Ultra High Capacity NiMH Battery:	500 g	
Average Battery Life @ (5-5-90 Duty Cycle) Standard High Capacity NiMH Battery:	Low Power  >11 hrs >14 hrs	High Power  >8 hrs >11 hrs
Ultra High Capacity NiMH Battery:		
Sealing:	Passes rain testing per IP54	
Shock:	Meets MIL-STD-810-C,D & E and TIA/EIA 603	
Vibration:	Meets MIL-STD-810-C,D & E and TIA/EIA 603	
Dust:	Meets MIL-STD-810-C,D & E and IP54	
Humidity:	Meets MIL-STD-810-C,D & E and TIA/EIA 603	



Transmitter		
Specification	800 MHz	
RF Output NiMH @ 7.5V:	Low 1W	High 2.5W
Channel Spacing	25 kHz	
Freq. Stability (-30°C to +60°C)	±2.5 ppm	
Spurs/Harmonics:	-36 dBm < 1 GHz -30 dBm > 1 GHz	
Audio Response: (from 6 dB/oct. Pre-Emphasis, 300 to 3000Hz)	+1 to -3 dB	
Audio Distortion: @ 1000 Hz, 60% Rated Max. Dev.	3% Typical	
FM Noise:	-40 dB	

Receiver		
Specification	800 MHz 25kHz	
Sensitivity 12dB EIA SINAD:	0.25 µV	
Adjacent Channel Selectivity ETS	-70 dB	
Intermodulation ETS	-70 dB	
Freq. Stability (-30°C to +60°C):	±2.5 ppm	
Spur Rejection:	-70 dB	
Image Rejection:	-70 dB	
Audio Output @ <5% Distortion	500 mW	

Specifications subject to change without notice. All electrical specifications and methods refer to EIA/TIA 603 standards. PRO Series radios meet or exceed requirements of MIL STD 810 C, D, E.

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## Glossary of Terms

Term	Definition
<b>ALC</b>	Automatic Level Control: a circuit in the transmit RF path that controls RF power amplifier output, provides leveling over frequency and voltage, and protects against high VSWR (voltage standing wave ration).
<b>ASF IC</b>	Audio Signalling Filter Integrated Circuit with voice compander.
<b>CD</b>	Compact Disk.
<b>CMP</b>	Compression.
<b>CPS</b>	Customer Programming Software.
<b>CSQ</b>	Carrier Squelch.
<b>DTMF</b>	Dual-Tone Multifrequency.
<b>DPL</b>	Digital Private-Line™.
<b>EEPROM</b>	Electronically Erasable/Programmable Read-Only Memory: used by the radio to store its personality.
<b>Firmware</b>	Software, or a software/hardware combination of computer programs and data, with a fixed logic configuration stored in a read-only memory. Information cannot be altered or reprogrammed.
<b>FGU</b>	Frequency Generation Unit.
<b>GaAs</b>	Gallium Arsenide: a type of crystalline material used in some semiconductors.
<b>ISW</b>	Inbound Signalling Word: data transmitted on the control channel from a subscriber unit to the central control unit.
<b>LCD</b>	Liquid Crystal Display: a module used to display the radio's current operating channel or system and scan status..
<b>LDMOS</b>	Lateral Difussion MOS.
<b>LH DATA</b>	Longhorn Data: a bidirectional 0-5V, RS-232 line that uses the microcontroller's integrated RS-232 asynchronous serial communications interface (SCI) peripheral.
<b>LLE</b>	Low Level Expander: slight amount of volume expansion; used to improve the signal to noise ratio.
<b>LSH</b>	Low-Speed Handshake: 150 baud digital data sent to the radio during trunked operation while receiving audio.
<b>MDC</b>	Motorola Digital Communication.
<b>MRTI</b>	Motorola Radio-Telephone Interconnect: a system that provides a repeater connection to the Public Switched Telephone Network (PSTN). The MRTI allows the radio to access the telephone network when the proper access code is received.

<b>MSK</b>	Minimum-Shift Keying.
<b>OMPAC</b>	Over-Molded Pad-Array Carrier: a Motorola custom package, distinguished by the presence of solder balls on the bottom pads.
<b>OSW</b>	Outbound Signalling Word: data transmitted on the control channel from the central controller to the subscriber unit.
<b>PC Board</b>	Printed Circuit Board.
<b>PL</b>	Private-Line® tone squelch: a continuous sub-audible tone that is transmitted along with the carrier.
<b>PLL</b>	Phase-Locked Loop: a circuit in which an oscillator is kept in phase with a reference, usually after passing through a frequency divider.
<b>PPM</b>	Parts Per Million.
<b>PTT</b>	Push-To-Talk: the switch located on the left side of the radio which, when pressed, causes the radio to transmit.
<b>RAM</b>	Random Access Memory: the radio's RAM is loaded with a copy of the EEPROM data.
<b>Registers</b>	Short-term data-storage circuits within the microcontroller.
<b>Repeater</b>	Remote transmit/receive facility that retransmits received signals to improve communications coverage.
<b>RESET</b>	Reset line: an input to the microcontroller that restarts execution.
<b>RF PA</b>	Radio Frequency Power Amplifier.
<b>RIB</b>	Radio Interface Box.
<b>ROM</b>	Read Only Memory.
<b>RSSI</b>	Received Signal-Strength Indicator: a dc voltage proportional to the received RF signal strength.
<b>RPT/TA</b>	Repeater/Talk-Around.
<b>Softpot</b>	Software Potentiometer: a computer-adjustable electronic attenuator
<b>Software</b>	Computer programs, procedures, rules, documentation, and data pertaining to the operation of a system.
<b>SPI (clock and data lines)</b>	Serial Peripheral Interface: how the microcontroller communicates to modules and ICs through the CLOCK and DATA lines.
<b>Squelch</b>	Muting of audio circuits when received signal levels fall below a pre-determined value.
<b>Standby Mode</b>	An operating mode whereby the radio is muted but still continues to receive data.
<b>System Central Controller</b>	Main control unit of the trunked dispatch system; handles ISW and OSW messages to and from subscriber units (see ISW and OSW).
<b>System Select</b>	The act of selecting the desired operating system with the system-select switch (also, the name given to this switch).

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<b>TOT</b>	Time-Out Timer: a timer that limits the length of a transmission.
<b>TPL</b>	Tone Private-line.
<b>μC</b>	Microcontroller.
<b>UHF</b>	Ultra High Frequency.
<b>μP</b>	Microprocessor.
<b>VCO</b>	Voltage-Controlled Oscillator: an oscillator whereby the frequency of oscillation can be varied by changing a control voltage.
<b>VCOBIC</b>	Voltage-Controlled Oscillator Buffer Integrated Circuit.
<b>VHF</b>	Very High Frequency.
<b>VSWR</b>	Voltage Standing Wave Ratio.

## Notes

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